

CLAIMS

What is claimed:

- Sub A2
- 1 1. A chemical-mechanical polishing slurry comprising:
2 a liquid;
3 cerium ions as an oxidizer in the liquid, the cerium ions being in a quantity
4 equal to the inclusion of at least 0.02 molar ammonium cerium nitrate in the
5 liquid;
6 an abrasive in the liquid, the liquid, the cerium ions and the abrasive
7 together having a first pH value; and
8 a pH increasing substance in the liquid that increases the first pH value to a
9 second pH value above 1.5.

- Sub A2
- 1 2. The slurry of claim 1 comprising cerium ions in quantity equal to the
2 inclusion of between 0.05 molar and 0.1 molar of ammonium cerium nitrate.

- Sub A2
- 1 3. The slurry of claim 1 comprising between 1 percent and 30 percent abrasive
2 by weight.

- 1 4. The slurry of claim 1 wherein the abrasive is silica.

- Sub A2
- 1 5. The slurry of claim 1 wherein the second pH value is at least between 2.5
2 and 4.

- Sub A3
- 1 6. The slurry of claim 1 wherein the substance is glycine.

1 7. The slurry of claim 1 which is environmentally green.

1 8. The slurry of claim 1 further comprising a complexing agent.

1 9. The slurry of claim 8 wherein the complexing agent is glycine.

1 10. The slurry of claim 1 further comprising an anti-oxidizing agent.

1 11. The slurry of claim 10 wherein the anti-oxidant is BTA.

1 12. The slurry of claim 11 comprising between 0.00200 molar and 0.00500
2 molar BTA.

1 13. The slurry of claim 1 comprising cerium ions in quantity equal to between
2 0.02 molar and 0.1 molar ammonium cerium nitrate and BTA comprising
3 between 0.00200 and 0.00500 molar BTA.

1 14. The slurry of claim 13 wherein the second pH value is at least 2.5.

1 15. A method of preparing a chemical-mechanical polishing slurry,
2 comprising:
3 adding together an abrasive and a complex cerium double salt as a source
4 of cerium ions.

1 16. The method of claim 15, wherein the double salt is selected from the group
2 consisting of ammonium cerium nitrate, and ammonium cerium sulfate.

1 17. The method of claim 15 wherein the double salt is ammonium cerium
2 nitrate.

1 18. The method of claim 15 wherein the abrasive and the source of cerium ions,
2 in solution, has a first pH value, the method further comprising adding a
3 substance which increases the first pH value to a second pH value above 1.5.

1 19. The method of claim 18 wherein the substance is glycine.

1 20. The method of claim 18 further comprising adding a complexing agent.

1 21. A method of forming a metal line, comprising:
2 forming a first layer, with an opening therein, over a semiconductor
3 substrate;
4 depositing a metal layer which fills the opening and covers the first layer;
5 applying a chemical-mechanical polishing slurry onto the metal layer, the
6 slurry comprising cerium ions as an oxidizer, and an abrasive;
7 contacting a polishing surface against the metal layer; and
8 moving the polishing surface over the metal layer.

1 22. The method of claim 21 wherein the slurry comprises cerium ions in
2 quantity sufficient to oxidize a portion of the metal layer, and the abrasive in

3 quantity sufficient to assist in removal of the oxidized portion when the
4 polishing surface is moved over the metal layer.

1 23. The method of claim 21 wherein the metal layer is of a metal selected from
2 the group consisting of copper and tungsten.

1 24. The method of claim 21 further comprising:
2 depositing a barrier layer over the first layer and before depositing the
3 metal layer, the cerium ions selectively oxidizing the material of the metal layer
4 over the material of the barrier layer.

1 25. The method of claim 21 wherein the metal layer is removed at a rate of at
2 least 1000 angstroms per minute.

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